THE IMPORTANCE OF THE SENSORY ATTRIBUTE OF ORDER.

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By H. J. Watt.

1. The Attribute as Such.

The attribute of order seems to be a most important feature of sensory experience. I have endeavoured for some time to show what can be done with its help towards the elucidation of the elements and complexities of the senses.[1] It seems worth while to display the significance of this attribute in a broader manner. In fact the interests of psychology and of epistemology (which falls largely, if not wholly, within the range of psychology) call for as broad a treatment as possible.

Let me first briefly state the nature and function of sensory order. It is a useful procedure in psychology to compare data of our various senses with one another so that we may, if possible, bring them under general terms of description, and thereby co-ordinate their variations exhaustively. We find of course that ground for this work has been well prepared by our predecessors. But the results they obtained are not such as could have been expected to be entirely convincing either to them or to us. At the best they seem inconclusive and fragmentary. The attributes we find in commonest acceptance are quality and intensity. There are not many psychologists now who would refuse to add to these an

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[1] *Cf. The Psychology of Sound,* Cambridge, 1917, and papers in *The British Journal of Psychology.*

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attribute of extensity, although most of them might decline to acknowledge its presence in every sensation. But I do not wish to enter into a discussion of the question whether any attribute of sensation must belong to all kinds of sensation once it is admitted as fundamental for any one sensation or sense.[1]

These three attributes may be said to be plainly evident on the face of (at least some) sensations. The probable reason why the attribute of order has not passed from the stage of latent or everyday (conceptual) usage to the precision of scientific objectivity is its lack of such clean-cut simplicity. We find an order of "points" in the visual field, an order of touches on the fingers, an order of tones in the musical scale, an order of colours in the spectrum, and so on; but these orders are not very obviously similar to one another. These systems of colours and of tones seem to belong together as qualities, while the others are clearly systems of localisations.

But why be concerned about such lack of unity, one might ask? May not any group of things form the basis of an orderly system? Surely the order of the system, on whatever basis of sensation (or of anything else) it may rest, and as constructed, is of conceptual origin. The "stuff" of the objects in question presents them in some sort of sequence or series, but our concepts label them with their own orders.

There can be no doubt that this latter process of labelling does occur: for example, in the case of the spectral colours. The local differentiation of the spectral lines of interference helps this procedure greatly, of course. Whether a purely qualitative group of differences could be conceptually ordered, apart from any correlative ordinal series, would form an interesting problem. Good examples for this problem lie to hand in the smells, the tastes, and the colours (especially if from the last of these we abstract the possible differences of "density,"[2] putting up only the six primaries white, black, yellow, blue, green, red, all of equal brightness). The question would then be: does the stuff of these differences give any basis for preferring one scheme of arrangement to any other? Or, is not an ordinal system conceptually inapplicable to them, except in a perfectly arbitrary manner?

Our present interest, however, begins at the opposite extreme. Namely: there are systems of objective differences whose ordering is neither dependent on caprice of the intellect nor on any (ordinal) system with which these differences may be objectively correlated, but is entirely (and objectively) inherent in them. Some of these systems are presented without any other variant (such as quality or intensity) in their members (not as between systems, but within any single system) than this inherent ordinal one. In so far as these systems belong to the senses, and taken in their simplest forms, they constitute the range of variation of the ordinal attribute as such. We find them in all sensory localisations and positions and in the pitches of sounds. I have pointed out elsewhere that ordinal differentiation is the common feature of these three kinds of sensory variants. It has been a fundamental error of previous psychological theory to attempt to analyse sensations on the assumption that the localisation that appears in the majority of the senses in some form or other is either a primary and simple variant or is a product of the combination of qualitative and intensive differences. These two assumptions characterise what are known as the nativistic and genetic theories of space perception. The nativistic theory is correct in so far as it denies the derivation of space from any attribute that is not essentially ordinal, in which sense the genetic theory is quite untenable. But localisation seems to be genetic in origin in so far as it is not an attribute of any elementary sensation but supervenes upon a certain synthesis or integration of these elements. It seems most probable to me that we can give the name of localisation only to that co-ordination of the ordinal systems of the different senses that is brought about by the similar determination of these senses by the physical objects that stimulate them. Or to reverse the statement: space is the name for a certain system of correlations between the (or some of the) ordinal differences of the various senses. In its sensory form we find this system already present when we begin any sort of conceptual activity. It is not itself, however, a conceptual ordinal system, as is the space of any form of (mathematical) thought. The ordinal system of sensory space must be prior, both in the individual and in general development, to any form of thought.

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[1] For these and other questions I must refer the reader to my previous papers.

[2] à la Brentano, *Untersuchungen zur Sinnes-psychologie*.

It is a corollary upon this fixation of the status of space that there may be ordinal systems of sense that are not spatial. This seems to be realised in ourselves only in the case of hearing, where the series of pitches forms a single dimension that is free of any sort of direct correlation with the ordinal systems of the other senses. It is a dimension to itself; every simple or pure tone of a definite number of vibrations lies round about one and only one point of the series, and the series is a continuity from lowest tone to highest tone. All sounds have, of course, besides, some sort of spatial localisation, which they obtain through the combined functions of the two ears. The foundation of this (spatial) correlation is necessarily, like the essence of pitch, ordinal. The difference is that the ordinal basis of it is independent of ("transverse" to) the dimension that constitutes pitch. And this transverse dimension is really correlated with the ordinal dimensions of the other senses.

In so far as any tone (or sound) is accurately localised, it stands in a system of four dimensions, namely, the three dimensions of space and the dimension of pitch. Thus the mysterious fourth dimension is realised in our experience in a very simple and inevitable way. The only blemish in the example is that sound of itself (or purely auditorily) is probably localised not in three spatial dimensions, but only in one, namely, in the transverse line of orders given by the two ears. But the case would hold if we granted sound the localisation that pertains to its source in the visual field. The interest of the matter is, of course, theoretical or speculative, not practical. The material organisation of the world may conceivably make it impossible to find anything that is qualified by four, and not less than four (such)[1] lines of ordinal variation. The upper limit may be three. But in our sensory experience we do find present more than three lines of ordinal variation, namely, for one instance, three dimensions of space and one of pitch. As far as these are considered merely as forms of experience and apart from their real dependence upon physical variants, they set no limitation upon one another. Therefore, from the point of view of sensory experience any number of dimensions is conceivable in connexion with one and the same sensory quality. At the most, however, only five seem to be actually found, namely, one of pitch, three of space, and one of time. All these are essentially ordinal.

A second dimension of pitch is quite conceivable, although there is not a trace of it in our hearing actually. How it might be realised, we cannot tell. But the actual basis of our third dimension of vision (stereoscopy) shows us that the range of possibilities is open and large. Each eye yields us only two dimensions: the lateral disparity of the images of the two eyes gives us solidity, which is thus realised without the use of a solid mass of physiological receptors. For all we know a second dimension of pitch might be realisable in ourselves, if we could procure the necessary physical variations required for, say, a pitch disparity of the two ears. But this sort of speculation is perhaps unprofitable.

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[1] I call them "systemic" in distinction from temporal order.

The articular sense or the so-called sense of active touch also gives us an ordinal manifold of two, if not of three, dimensions. The differences appreciable in the different relative positions of the two limbs that meet in a joint, it is true, are not usually described as ordinal but as qualitative. But that classification seems to me to be certainly wrong. In the present connexion this sense is of interest only because its ordinal differences are not usually said to be spatial or localisational, but to be differences of position. Thus they form, in a manner, a companion to the pitch series and confirm the need for abstracting the ordinal variation from that of localisation for the purposes of the ultimate analysis and reconstruction of sense.

The study of the sensory attribute of order is, as I have variously tried to show, merely the foundation of an indefinite process of study by which the senses seem willing to be shuffled into a complete parallel with one another, and by which thereafter all the other cognitive functions seem likely to be much more intelligible than they have been hitherto. In the following pages I wish to give some account of these changes of outlook, especially towards the cognitive group. The former I have already pursued in considerable detail. But that thoroughness can be attained only for portions of the vast field in question and even then at best only in a temporarily adequate way. A sketch of portions of the field that are based on an inadequate survey can have value only as a rough guide or plan of approach. Some problems will doubtless withstand the effort to penetrate their obscurity, especially those of the qualitative differences of vision and still more of smell.[1]

The way in which the attribute of order brings the senses into conformity with one another may be illustrated by the case of hearing. The attributes are the result of the comparative analysis of the simplest elements or particles of sensation. Having brought these into a probable general agreement we should naturally expect to find that this agreement will extend to the simpler complexities of sensation. In the sense in which we are most keenly expert, namely, in vision, we find prominent a group of complexities of which distance is probably one of the simplest, other varieties being line, mass, surface, outline, and forms of all kinds. Another prominent group adds to all these the feature of motion. It is not difficult to state a general relation between these complexes and the variable attributes that appear in their parts. When we turn to hearing to seek a parallel to these, we must remember that we have established in uniaural hearing only a single dimension of pitch orders and that consequently all pitch forms and motions can be only of one dimension. In the transverse dimensions of auditory orders that the two ears mobilise for us we may similarly look for spatial forms and motions of only one dimension. And this is approximately all that the direct localisational capacity of binaural hearing affords.

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[1] A very interesting arrangement of smell qualities has recently been proposed by R. Henning.

The forms of pitch are found in the volumes of sounds (especially of tones) and in the intervals and chords of groups of tones. Their motions appear in the melodies of successive tones. The same fine sense of proportion that we find in ourselves for the proportions of visual distances and lines appears again in our familiar delicacy of discrimination of intervals—which are the proportions of auditory volumes (or pitch lines). It is of the greatest importance for the theoretical foundations of music that these things should be worked out in the finest detail. But it would be impossible to sketch them intelligently here.[1]

In the sense of vision a complication of the greatest importance appears which by a peculiar interlacing of two visual fields adds a third dimension to vision. This new dimension is not the result of any sort of cognitive correlation of the contributory fields; it is a sensory fact, as much visible as is either of the primary dimensions of a single field. This fact is really undeniable by anyone who has carefully considered the simpler aspects of stereoscopic vision. The attempt has often been made to bring the sense of solidity under the head of the products of "experience" by reference to some other source, especially to touch and muscular movement; but without success. The fact of stereoscopy, as it can be demonstrated so simply with the stereoscope, is much too "solid" to be thus explained away or to be converted into a by-product of the mere succession of any simpler (two-dimensional) forms.

The acceptance of this creative synthesis and its product must incline our judgment in the case of space, greatly in favour of a similar process, although the product here is not by any means so obvious. But it seems clear, that space cannot be set down as an original or inherent feature of any one sense. The case of pitch-hearing compels us to admit as inherent in any sense only an ordinal field or system and to reserve space for a stage beyond even that of stereoscopy. In that further stage the different senses become correlated to one another. This probably happens in virtue of the similar forms and motions that appear in the different senses and their conjoint variations and displacements (a very complicated matter, of course). But the case of stereoscopic vision again warns us that we must not set this down as the result of cognitive correlation, *i.e.*, as a correlation through the medium of the identity or similarity of the conceptual schemes or ordinal systems that we bring forth from our intellect and attach to the presentations of the various senses, as far as they will fit them. We have no right thus to presuppose a conceptual intellect hovering over the turbulent chaos of sense and weaving it into a hierarchy of orders. It is out of the question that the intellect could create any typical synthesis of sense. This must in each case first appear, if the intellect (when *it* appears) is to set to work upon the former and to support and to enlarge it. However much evidence of conceptual correlation there may be in our advanced studies of the world of space, we can hardly doubt that space is a specially distinguished and unified system of orders to which all the relative ordinal dimensions of all the senses are attached.

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[1] *Cf.* my two books on the subject, *The Psychology of Sound*, Cambridge, 1917, and *The Foundations of Music*, Cambridge, 1919.

The pitch dimension of sound alone stands outside the spatial system. But this one exception is brilliantly instructive. For it shows that the spatial system is so clear and distinct, and that all the senses are so vividly attached to it that we have previously entirely failed to grasp the variations of tonal pitch as an ordinal digression excluded from it and irrelevant to it. Even when the true character of pitch has been in some manner encountered, the first and prevailing inclination of most analysts has been to describe it as "quasi-spatial". On the other hand the systems of the senses, especially of vision, are so closely attached to a spatial system that each of them has often been thought to be equally and similarly spatial in its own degree of complexity. It has required a special motive like that of the exceptional nature of the tonal dimension to force us to abstract from stereoscopy the notion of spatiality and to recognise the binocular stereoscopic field as a merely tri-dimensional ordinal system, in which we encounter *forms* not spaces. In looking into this system, we indeed seem to be looking into space. But it cannot be spatial originally. It becomes so only when all our senses and their systems become woven into one space. And this new system establishes itself so firmly that we find it quite hard to separate the original components of it from one another and to contemplate them singly and independently. It is only because the spatial inter-attachments of the senses are so vivid and cogent that so many theories have been propounded and accepted whereby one sense was supposed to bestow its special spatial favours upon others in which they were not native.

The tri-dimensional system of vision is so vast and detailed that it may often seem as if it were really the spatial system itself. We look over our visual field and we seem to look through space. But the doubts as to the primacy of distance-from-the-spectator in vision are an indication that men commonly seek for space some sort of background of resistance beyond the panorama of sight. Touch or resistance or movement from point to point seems to lend it substance. And yet none of these is by itself in any way superior. If we shut our eyes and move about, we feel that we shall only fully grasp the extent of our movements when we open our eyes and look. It seems clear in general that sensory space is not inherent in any or each of the sensory fields, but is a structure resting upon all of them at once so far as each is given at any moment, involving them all, and in turn supporting each. The minute study of the many processes that contribute to the elaboration of space must be a very extensive task. One of the hardest parts of it is the separation in ourselves of what is at any moment given of the spatial construct (*i.e.*, what of it is sensory) from what is potential, based it may be upon the dispositions of mere habit or, as in ourselves rather, upon conscious dispositions and expectations and upon conceptual constructs of an everyday kind.

Thus it will appear that we have to reckon not only with the various ordinal dimensions of each sense, *e.g.*, the three of vision, but also with the three dimensions of sensory space which are founded upon these and link them together, not to speak of the conceptual space or spaces that are constructed in cognition. Only, in these different spaces it is not a question of gathering them together from their foundations into one vast system of numerous dimensions, but of generating at each level a new system of three dimensions, in a new mental stuff, as it were. The two bi-dimensional visual fields form one tri-dimensional field; the various bi- or tri-dimensional fields of the senses generate a single tri-dimensional sensory space, small as an actuality no doubt, but in ceaseless flow through its greater potentialities, which may be fixed by habit or memory. When conception supervenes, it generates a new and more perfect space that will incorporate all the succeeding and repeating actualities of sense. Each ordinal manifold, however, once it is formed and filled can be stated purely in its own terms; in fact, it cannot be stated otherwise, although for the justification of its contents we doubtless can and must look downwards to its springs in the data of sense.

At the same time it should be noticed that the earlier system does not seem to be taken up, and to disappear, into the later system that rests upon it. The earlier is still maintained *under* the later or more integrated one, as it were. Thus the ordinal systems of the two ears merge into one binaural field, which adds to the functions of either that of binaural localisation. But though we hear with two anatomical ears as if we had only one functional ear, yet we have good reason to believe that every ordinal element of either auditory field appears, and has its function, in the binaural field. There is nothing lost by such psychical integration. Similarly in binocular vision, we find a functional unity alongside the anatomical duplication of organs. Our vision has for this reason been called Cyclopean: we see with two eyes,—each of which, when motionless, is incapable of seeing the solidity of stationary bodies,—as if we had one eye midway between the actual two and capable of seeing solidity; as if we had one eye in the middle of the head with which we could see as well as men generally do with two. Now it is obvious that the visual field of the two eyes together is more extended than that of either eye separately, namely, by the amount of the field that is apprehended by each eye to the exclusion of the other. But only the central binocular part is functionally binocular, or capable of showing solidity. At the same time we are aware of the whole field as an apparent unity. Nevertheless it is a familiar fact that this binocular area is crowded with double images of the things we see, so crowded that on discovering this we are lost in wonder that we get any sort of coherent single vision from it at all. A little block of what we see is indeed single and solid; but a much greater part is not so. Only, we are interested exclusively in what is thus single and solid, and when our interest turns upon the doubled objects they become so rapidly single that we fail to notice they have ever been double. The important point in this is that at a certain moment we turn our interest from a single solid object upon an object that until that moment was doubled in our vision and that our eyes respond so rapidly and correctly to this interest that they make it possible for us very rapidly to see the new object single and solid; so rapidly indeed that we remain unaware that it was ever doubled. Each eye moves correctly so as to catch its own particular image. And so we may infer that this image was there in its doubled psychical form although we did not know this. The psychical reality of double images is usually allowed by those who study this question. What is rarely, if ever, conceded, is that even in the single solid sights both contributory images are there psychically. But if the one point is admitted, so must be the other surely. When there is integration there is unity (single, solid); without integration there is duplication (double, flat). Where unity is patent, we cannot expect duplication (or disintegration) to be patent. But we may have good reason to believe that duplication may then occur in a latent form.

Similarly, space is a new system of orders that arises from the ordinal integration of the several senses. But these it does not obliterate or annul or diminish, as we are all perfectly well aware. And yet, it is so closely incorporated in the ordinal system of each sense, that we have been generally disposed to look upon these, not as merely enriched by the spatial integration, but as originally spatial. In this case we have reduced our concession of unity very greatly from that seemingly required in binocular vision. This change in our attitude can only be due to the clear differentiating effect of the qualitative distinctions of the systems that contribute towards the spatial integration. In the two eyes we usually find a very close parallelism of qualities, except in the case of lustre or of similar experiments in the binocular combination of different colours. And it is notorious how such different colours tend to break up the unity of vision and cause a rivalry of images. But it seems very clear that we must similarly admit that the ordinal fields of the various senses are not originally spatial, but merely ordinal in that limited sense in which the series of pitches is completely ordinal and yet not spatial. And the "stuff" of these different fields is originally different, however unitary the spatial field may finally appear to be to which they all become attached. In other words, the orders of the different sensory fields are conserved within their spatial integration.

2. A Possible Objection.

It is thus we must also approach the objection that may be raised to the admission of ordinal differences, namely, that these differences are perhaps always for the larger part latent or implicit, not explicit. A patch of colour can easily be so arranged that no points are separately visible in it at all. It will, of course, necessarily be distinct at the boundary of the patch, where it is surrounded by the rest of the field of vision, every part of which is always full of sensation. These boundaries are heightened in all cases by some form of contrast, whether of colour or of brightness. Within the patch lie all the orders of the many minimal points of colour that could be seen and differentiated under proper conditions, *e.g.*, when the patch is gradually reduced to disappearance at its various points. We may suppose, if we like, that every visual sensation, no matter how small, is still a mass or area of sensation, having some amount of extent, and that it is therefore rather a system of orders than a single order, even when minimal. But we must be careful not to allow mathematical notions to confuse the issue. It would doubtless be rash to speak of individual orders of the visual system in any absolute sense, as if their number could be counted. The number of just discriminable differences can be approximately estimated and in vision we might perhaps venture to put down the number of minimal particles of sight as the number of cones in the whole retina. It is doubtful whether such a procedure would serve any useful purpose. But it is important to observe the lowest limit in vision of a capacity to distinguish points from one another or to detect the displacement of a point under favourable circumstances. And there is no sense or sanction for conceiving of visual orders within or below the limits of this finest discrimination. Even if finer differences are implicit within the minimal mass, we cannot make these differences explicit, nor have we any indirect warrant for maintaining the existence of finer differences.

But within the larger patch of colour the contrary is true. We can make explicit all its latent differences and we have indirect sanctions besides. These are mainly of two kinds. In the first place the size of the patch is, in general and under similar conditions of convergence of the eyes, relative to the number of discriminable particles included in it. The greater the magnitudes that constitute the form of the patch, the larger the number of particles on which they are based. And the position of the patch in the field of vision depends upon the particular orders that make up the patch and their absolute differentiæ as orders of the visual system. Two patches in different parts of the visual field may be of the same size, even though none of the ordinal components of the one appear in the other. And any patch always has a definite status in the visual field that marks it out as such from every other visual patch of equal size, or from any patch in the other field of vision.

The tendency to assume that what is implicit in sensation is non-existent there, is responsible for the prevailing failure to distinguish an attribute of order and for the tendency to assume that the intellect could by some sort of manipulations somehow work into an undifferentiated continuum differences that were not originally contained in it, or could bunch together into "signs" of loci (that are not given) qualitative and intensive differences that have themselves no ordinal differentiation. It has never been shown how such transformations could be brought about. It is just as arbitrary to suggest that the intellect could in any other manner either grade or arrange sensory extents so as to arrive at a notion of (mathematical) points,[1] or having drawn an ordinal system from its own deep well could apply this system to sensory material that itself is not ordinal. If you cannot get something out of nothing, neither can you give nothing body by dressing it up in the form of something. Wherever the ordinal systems of mathematics come from, it is clear that they can be applied to the stuff of sense only if that stuff itself contains ordinal differences both explicit and implicit. Then there is no difficulty whatever in the application in general. A serious problem arises only when we ask how the infinitely fine orders of mathematical thought are to be applied to the gross differences of sensory order with a profit that shall repay the labour. The disparity between the two makes one think one might as well set out to read a book with an oil immersion lens. The procedure would indeed be futile if the sense-data to which we suppose mathematics to be applied were merely the sense-data of a single soul as such, or were such data as pain (toothache or colic) or hunger or thirst. These have their place in space it is true, but they are the channels of practically no knowledge of the movements of any bodies in space. In touch and still more in vision, on the contrary, sense-data almost invariably enter fully into our spatial constructions and bear in themselves valuable data for knowledge of the positions and movements of bodies in space. This space is already larger than the actual sensory space of any one moment before the intellect begins to endeavour to apply its mathematical thought to it. And the knowledge mathematical thought then wishes to confirm and to extend is already significant knowledge of some degree of certainty about more or less permanent bodies, processes, or distances of (physical) space. By this means the rough data of sense, that seem so rough when we consider the narrow limits of the actual field of any sense at any moment, become relatively exceedingly fine in the vast space attained before the mathematical study of space and its contents begins. The roughness of the sense-data does not then diminish. But what was as sense-datum a mere speck in a small field of vision has become a mere speck in the heavens or on the earth many miles removed from its fellow. We may well long for a more microscopic eye, but no one of us would ever complain of the smallness of the world.

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[1] "The manufacture of points from sense-data" devoid of positional character (*cf.* Mr. Russell's *Knowledge of the External World*, pp. 114 ff.) seems to me for this reason to be a vain effort. Without ordinal differences which are the only justification of this application, one might as well show how quills can be manufactured out of angels' wings or heather out of golden mountains.

This point may perhaps be made somewhat clearer by a comparison of vision with hearing. The pitches of hearing are ordinal differences like those of vision, and we might just as reasonably apply mathematics to the former as to the latter. But no one would expect any profit from doing so. And the reason can only be this, that the pitches of hearing, as a matter of fact, stand in no real correlation with physical objects and with positions and movements in physical space. As far as physics is concerned, there is about as much profit in applying mathematics to sounds as to hungers or pains. In relation to music the procedure, primitive though its extent be, is of considerable value. But if it were the case that sounds like lights stood out in space in positions as definitely distinct as their pitches can be physically defined, our delicacy of pitch discrimination and its ordinal character would undoubtedly form a most important basis for knowledge of the physical world. But as they do not do so they are useless for that purpose.

It may seem to be a fatal weakness in this argument that space and some knowledge of its relations is supposed to be present before mathematics begins to work upon them. Surely we must first justify this space and our knowledge of it and for that justification mathematical constructions may seem to be an essential preliminary. If this implies that we somehow have the intellect and its methodology in the background from the beginning and that these somehow allow themselves after careful scrutiny to be applied to the data of sense and to make them work, the view is surely mistaken. The intellect can make nothing work; it is not a transferable power. Not only that, but it must itself be an effect and not a source of determination. It rests upon the senses and it cannot justify out of itself the ground it stands on. It can certainly scrutinise the work of the senses and their integrations, and so bring its own reflection (or its knowledge) of them into complete conformity with them. In other words it can adjust itself more and more perfectly to the senses, as it does to the world in general. It grows more and more orderly by allowing the orderly determinations that proceed from the world and the senses to permeate it more and more thoroughly. But it can do nothing towards forming or initiating the operations of these integrations themselves.

It is for this reason that mathematical thought can only get to work on the data of sense after these have themselves been highly elaborated and already signify space, its contents and their relations. The work of epistemology must be more a process of learning exactly the ground knowledge stands upon than of justifying that ground. If it justifies itself, it can only do so in the sense of knowing its own *de facto* basis and of *being* itself more actively or fully (*i.e.*, more correct). Kant's point of view is here generally valid. You cannot bring space from anywhere and apply it to the data of sense. For you have nowhere to bring it from, and if you seem to bring it, you deceive yourself; for it was already there all the time, as an accomplished fact. Nor can you elaborate space out of non-spatial sense-data by some higher mental process ("experience" or thought). You must simply admit its presence as a feature of the sensory world. This attitude is valid not only for space, but for any other special synthesis or "form" of experience in general.

3. The New Outlook Provided by the Attribute.

Having thus shown the necessity of admitting the presence in sense-data of an attribute of systemic order and having brought the simpler complexities of sense into connexion with the attribute in a way that seems not only correct and profitable as far as it goes, but also gives some prospect of being in time brought to completion, we may now proceed to indicate what further services towards the elucidation of experience may be expected from this attribute and the scheme of integration it suggests.

One of the first is an understanding of the general problem of cognition itself. What is cognition? Explain to us what it is to know. That has always seemed to be an impossible task because there is surely nothing in the world like knowledge. It is *sui generis*. Who shall show us its fellow? This may well seem a hopeless question. But without some positive answer to it, how could there be any semblance of a science embracing and explaining knowledge. Over against a perfectly unique thing science would be powerless; for science must generalise, if it is to succeed. And it can do so, only by the grouping of like objects or by the orderly arrangement of similar ones. Thus we can hope to explain knowledge only if we can give it a place in the system of experience, whereby it will be seen to occupy a definite position in that system alongside other forms of experience that will then for the first time reveal their similarity to it.

Now the only attributes of sense-data that seem to attain more than a mere trace of complication are the ordinal ones, and of these systemic order seems to go much farther than does temporal order. The latter attains only the simple degree of complication, namely, that of simple forms such as time intervals and rhythms. The interaction of time intervals with one another shows traces of the illusions that are so familiar in systemic forms, especially in the sense of vision. But there can be no doubt that the systemic attribute reaches a higher grade of integration. Stereoscopy is undoubtedly based ultimately upon this attribute, through the intermediate complication of simple forms, of which each single eye is capable. Under conditions of motionlessness of both the eye and its objects, only the integration of these simple forms from both eyes at once will yield stereoscopy. Moreover, there can be no reasonable doubt that the proximate basis of sensory space is the forms that appear in the different senses owing to the common stimulation by physical objects. No one would suggest that thought is an efflux of time and its forms. Nor has it anything to do with the qualities or intensities of sense. And yet it is clearly based upon sense. That has been a prevalent belief in all ages of philosophy. Though the forms of the understanding may be *a priori*, yet they are filled and determined by the changes of sense—without a doubt. And now we begin to suspect that the forms of understanding are *a priori*, only in the sense that they are general or typical while their determinations through sense are particular; but that both these forms in general and their particular shapes are brought about in one and the same process. Sense is the basis of intellect, building it and filling it in identical operations.

If this be so, then the only basis in sense to which we may hopefully ascribe the functions of cognition is the systemic ordinal attribute and its line of integration. Cognition would thus be its outgrowth or integrate.

Much, of course, if not all, has still to be done before such a conclusion could be said to have been established with all the vigour of scientific scrutiny. We should require to make a microscopic examination of many instances of thought processes. We should have to establish the ordinal nature of thought by the widest possible survey of its forms and by study and inferences from its relations to other experiences and even to the body.[1] This would be a task requiring the fullest and most detailed experimental studies. Mere introspective observation is not enough, although that would have to be procured in its finest forms. A great deal of inductive arrangement and inferential approximation would have to be done before the statement of the case could be held to be satisfactorily attained. We should have to learn to pin cognition on to its basis properly, as in organic chemistry the highly complex compounds are gradually analysed and placed correctly in the hierarchy of compounds.

It is only by such procedure as this that we can hope to bring sense and cognition into perfect continuity and so to discover their common root. Not that this root is precisely common to both, as if each were a stem bearing its own branches and leaves. It is more probable that sense is the root of intellect, drawing its food of specific determinations from the physical world and at the same time building up from that nourishment a stem and branches finally bearing in the intellect a vast wealth of leaves, blossoms, and seed.

If we can hope by such means to give some explanation of cognition, we may also aspire to an understanding of the mysteries of recognition and memory. The obscurity and wonderment of these has always been felt to lie in the consciousness of renewal, of again-ness, that attaches to them. It seems an impossible task to explain how we can become conscious that a present experience has been ours before. But the practical needs of recognition are served not so much by a consciousness of repetition, though that may be in some respects a more striking experience, but by the knowledge that an experience that we have for the first time is new to us. And that can be explained easily enough if we suppose that both in the complex mental life of man and in animal life that is characterised rather by habits, effects are produced by a first-time experience that are at least as important, if not more important, than the effects produced by its repetition. These effects are forms of excitement on the animal level and forms of conceptual awareness in the human. We ourselves certainly share in both kinds and we may often cognitively infer from excitement to recognition (as a conceptual idea) or our recognition may often be an immediate knowledge of conceptual wholes to which the experience in question belongs. If we already possess a cognitive structure and a (new) part is now added to it, we shall hardly fail to pass reflexions on this addition, noting its date, its cause, its significance, etc. When the extended whole or the part by which it was extended recurs, the basis of recognition has not then for the first time to be won, but merely to be used, having been provided in the first occurrence. If recognition takes place at a level below cognition proper, say at perception of particulars, then upon the first formation of the perception, not only will the perception form an item in some ordinal scheme, for example of spatial position or temporal sequence or habit series, but it will then form attachments with its neighbours, attachments, it may be, of association between perceptions or between muscular expressions. On renewal these associations will be revived in their degree of strength and will carry the mind forwards in a way impossible in the first instance.

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[1] For the style of argument I may refer to my discussion of the ordinal nature of pitch.

It is, however, a fact familiar to all who have approached the subject in detail or experimentally, that the distinction of the various forms of recognition has not yet been fully carried out nor has their exact status in the scheme of experience been determined. I do not wish to prejudge the outcome of these studies in any way. The point I wish to emphasise is that the conception of an ordinal system rooted in the data of sense and of the various ordinal systems raised upon that basis by successive integrations seems able to remove from the notion of recognition the hopeless mystery that has been one of its most striking features.

The same applies to memory. In memory we come face to face with another striking characteristic of cognition, its special power of association, by means of which the little surface (as it were) of the conceptual contents of the mind at any moment is held in its place as a part of an indefinitely larger area in which we can move about by the bonds of association with an indefinitely great freedom. The relation of the brain to the faculty of memory is a special problem of psycho-physics. Psychology is concerned primarily with the determination of the exact place of memory in the whole scheme of experience, with its explanation in virtue of that position, with its springs in the actual cognitive contents of any moment, and with the precise description of the manner in which these contents change progressively from moment to moment in the process of remembering. The problem of the unconscious, of the mode of being of memories when they are not actually revived, appears at this point; but I do not think that it necessarily enters into the discussion of the preceding questions. It is a special question, which we hardly seem likely at present to further by discussion.

4. Relation to Psycho-physics.

If the course of experimental psychology and its approximative theoretical interpretation bears out these suggestions, we should at last have an hypothesis upon which all the work of psychology could be concentrated. Even in the present fragmentary state of our knowledge of detail the idea promises to dispel a great deal of the mystery attaching to the mind and its various faculties and their connexions. That is a great merit and would alone suffice to give the idea some value of probability. Even if the indications I have made are not borne out in detail, we may at least expect the successful interpretation of the cognitive functions of the mind to take on a form similar to that suggested.

It is a general principle of the elucidation of the greater systems of reality that the higher or more complex or more inclusive shall be founded upon the lower or simple or more restricted, and that the features of the former shall be shown to run into or to underlie those of the latter. Thus the heavens have become other worlds, in all general characteristics greatly resembling the earth we live on; the complex substances found in plants and animal bodies are members of the groups of elements and their combinations of which the physical world consists; the higher animals are the later products of an evolution sustaining and moulding all animal life. Even heaven itself, to the modern mind that is so rightly impressed with the methods and principles that have proved successful in the science of the last two or three centuries, must be fashioned from the dust of our present imperfect life. Not new material is required, but only a better spirit to inform the whole. The study of the mind from its foundations in sense seems only to confirm this general trend of thought. The high functions of intellect are rooted in the fragments of sense.

We may express this otherwise by saying that the intellect is a natural outgrowth of the world as it is represented in sense. It is not a visitant from another sphere, somehow attaching itself to the world of sense with which it has no inner kinship and looking through and beyond sense to the real world. It is this primary admission of estrangement that accounts for the seemingly insuperable difficulty of justifying the assumptions that the intellect makes regarding a real world "beyond" the senses. Naturally until the inner bonds of cognition and sense have been discovered there can be nothing but seeming arbitrariness in these interpretations. The gift seems beyond the powers of the giver to bestow and we feel unhappy in doubting its honesty. By what privilege does the intellect stand in the background, and evidently secure in the unquestioned strength of its own faculties, submit all the complications of sense to its own particular canons and measures? What right has it to criticise? Is there more light and power in its decisions of right and wrong than in the interactions characteristic of experiences of lower levels, *e.g.*, in the harmonies and discords of sound, in the agreements and disagreements of colours with one another, in the oppositions and enhancements of pleasures and displeasures? By what right is it a judge in the discipline called epistemology? Surely it is clear that there must be in all levels of experiences an aspect akin to that which we know in cognition as truth and error. The latter cannot be a fundamentally new thing. If so, then all these aspects at their respective stages have equal and similar functions and the intellect can no more criticise and regulate them than it can discover itself over again or establish its own validity by argument. The intellect can only adjust itself to them so as to portray them in its own way—correctly. But it cannot justify them any more than man can convert himself into a mouse.

On the contrary, far from being a stranger to sense, intellect must be its offspring and, after the strange fashion of much of this world of ours, at the same time its strength and support, binding it into a strong coherent whole. Intellect is merely one level of the world's own order, bound to the latter by penetrating ties and in constant interaction with it: its child and partner at once. The mystery of mind lies not so much in the forms of intellect, but in the qualities of sense, such as the smells and the colours, and the single qualitative differences of the other senses. But it may be that these are strange to us merely because they do not combine and complicate into higher levels as do the ordinal aspects of sense. Quality is a whisper to us of worlds we can only guess at. But the repeating integrations of systemic order have made us much at home in the world, so that our intellectual gaze seems to penetrate its greatest depths. Our minds mirror the world in its order. Mind is in so far a mere extension of the order of the physical universe, a part of it in that respect. The currents of the world penetrate it and run through it without loss of their detail of differences. It is true we can never feel the warmth of the world's being, its inner light and essence, the springs of its spontaneity. But we can feel and know almost its every part and movement and the principles of its changes. And if we fail not to grant it the life and spirit that we feel in ourselves, it cannot be such a wilderness of stocks and stones as many despondently believe who miss in it the rich qualities that we find in sense.

With this in view we can begin to understand how it is that the brain thinks the world, as it were. The brain is a vast structure, but it is at least clearly a whole of parts. The senses enter by different portals and are housed in different regions of it. Each of them is in the first place an intimate system with its own range of simple complications. It is a patent fact that these systems come into close correlation with one another. It is not necessary to think of this, as has perhaps been the prevailing tendency, as an association of images; it is just as likely to be the sort of correlation above ascribed to sensory space, before it is an association of images. Beyond these general indications it has as yet been impossible to carry the interpretation of brain in terms of mind.

But if cognition is prevailingly ordinal in character and is an outgrowth of the complications of the ordinal attribute of sense, there can be no difficulty in carrying on the idea of progressive correlation of brain "centres" upwards or inwards to the hypostatisation of a cerebral substitute for thought itself. It is true we do not know the location of this in the brain, nor are we perhaps likely to learn much about it soon. But it may well be accepted as a general notion for the interpretation of the brain as the organ of mind. The points of the brain at which occur the combinative groupings of groupings that finally reach to the elements of sense will be the cerebral correlatives of the thoughts whose mental function is a similar grouping of groupings of sense-data.

In the brain substrate of the qualities of sense we have probably the highest possible development of the (chemical?) specialisations of neural matter, especially in vision, smell and taste, and hearing. In the other senses there is more homogeneity, though they doubtless differ somewhat from one another. The neural correlate of ordinal differences and their integrative complications and finally of thoughts may well be a still more primitive and generalised process. We can hardly tell. But at least it should be no longer difficult to think of the brain as the organ of the cognitive mind.